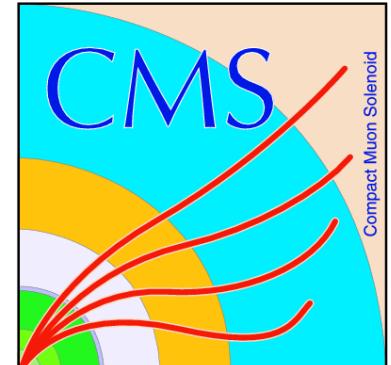


Delphes Fast MC for Snowmass

John Stupak III on behalf of:

J. Alimena (Brown), A. Avetisyan (Brown), J. Hirschauer (FNAL), D. Huizenga (Purdue Calumet), S. Malik (UNL/FNAL), Z. Mao (Brown), M. Narain (Brown), S. Padhi (UCSD), N. Parashar (Purdue Calumet), S. Sirisky (Brown), M. Slyz (FNAL)

April 4, 2013

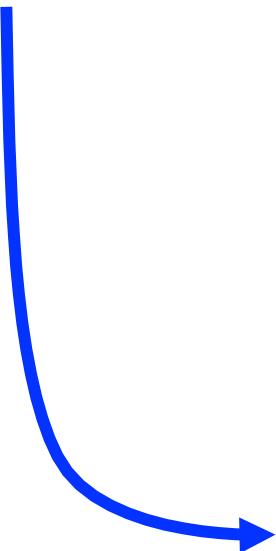


Introduction

- Sanjay gave an excellent overview yesterday
 - I will focus here

Outline

- Introduction
- Challenges with LHC and detector upgrades
- Overview of current ATLAS and CMS detectors
- Combined LHC detector for Snowmass Studies
 - Parameterized detector simulation using Delphes (with Pileup)
- Performance studies using parameterized simulation
- Common backgrounds for Snowmass – Generation and Simulation
- Storage and replication of samples
- Thoughts due to expected increase in pileup interactions
- Summary and Conclusion



Background Generation

- Problem: ATLAS and CMS need **large samples** of background MC for variety of analyses on **short timescale**
- Solution:
 - Generate 10-100 million events per background with [Madgraph](#)
 - Use [Pythia](#) for fragmentation and hadronization
 - Perform fast reconstruction with [Delphes](#)
 - A single “LHC-like” detector
 - Make resulting MC accessible to anyone



performed centrally

Event Generation

- We are in the process of generating events with Madgraph 5:
 - Running opportunistically on the OSG
 - Peak
 - ~100M events/day
 - Average
 - ~50M events/day
- Fragmentation + Hadronization
 - Using Pythia 6
 - Fast

Recipe: https://twiki.cern.ch/twiki/bin/view/CMSPublic/NPSnowmass2013Samples#To_produce_LHE_events_from_a_gri

Common backgrounds and simulations

Statistics of event samples generated so far:

Background samples	13 TeV LHC (events)	33 TeV LHC (events)
ttbar+Jets(0-4)	~50 M	~ 40 M
W + Jets (0-4)	~25 M	~ 40 M
Z + Jets (0 - 4)	~5 M	< 10 M
WW+Jets (0-2)	~ 10 M	~ 40 M
WZ+Jets (0-2)	~ 10 M	~ 20 M
ZZ + Jets (0 – 2)	~ 20 M	~ 40 M
WPhoton + Jets (0-2)	~ 20 M	~ 20 M
ZPhoton + Jets (0-2)	~ 20 M	~ 20 M
Photon + Jets (0-4)	~ 20 M	~ 20 M
Di-Photon+Jets (0-2)	~ 20 M	~ 20 M

<https://twiki.cern.ch/twiki/bin/view/CMSPublic/NPSnowmass2013Samples>

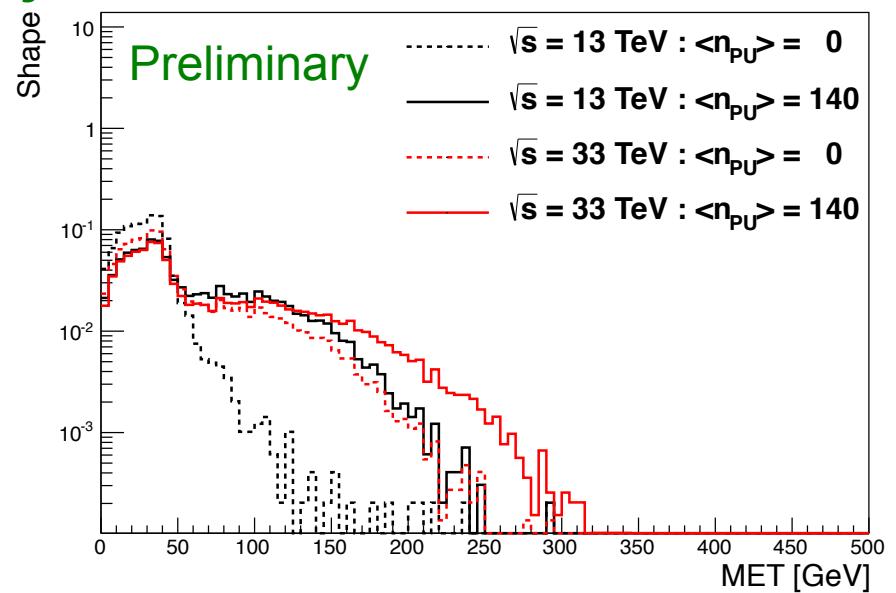
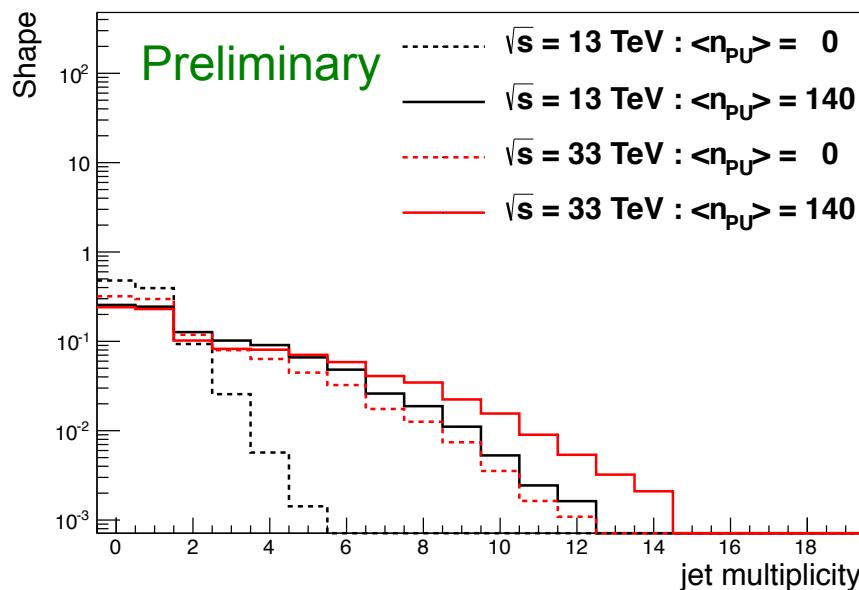
Fast Reconstruction

- Recently began reconstructing events with Delphes 3 on cmslpc.fnal.gov
 - Preliminary recipe:
https://twiki.cern.ch/twiki/bin/view/CMSPublic/NPSnowmass2013Samples#Delphes_3_Production_Recipe
 - Generic LHC-like detector
 - Take best of both CMS and ATLAS – work in progress
 - Pileup mixing
 - $\langle n_{PU} \rangle = 0, 50, 140$  not yet
 - Using slightly modified version of Delphes-3.0.5
 - Default version produces artificial spikes in the jet η distribution
 - Also modified to reduce output size
- When technical challenges are worked out, will transition to OSG for reconstruction

Fast Reconstruction Results

The MC samples are currently undergoing validation

$W + \text{jets}$



$$p_T > 20 \text{ GeV} \quad |\eta| < 2.5$$

Output Storage

- Writing Delphes output to FNAL, BNL, and UNL
 - Accessible via SRM, XRootD, and http
 - SRM: srm.unl.edu
 - XRootD: red-gridftp11.unl.edu
 - <http://red-gridftp11.unl.edu/Snowmass>

Index of /Snowmass/Delphes-3.0.5-Snowmass-1.0

	<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
	Parent Directory		-	
	PileUp0/	01-Apr-2013 13:57	-	
	PileUp50/	01-Apr-2013 13:00	-	
	PileUp140/	01-Apr-2013 13:00	-	

Output Storage

Index of /Snowmass/Delphes-3.0.5-Snowmass-1.0/PileUp140

	Name	Last modified	Size	Description
	Parent Directory		-	
	DIPHOTONS_13TEV/	01-Apr-2013 12:57	-	
	DIPHOTONS_33TEV/	01-Apr-2013 12:57	-	
	PHOTONJETS_13TEV/	02-Apr-2013 09:20	-	
	PHOTONJETS_33TEV/	01-Apr-2013 12:58	-	
	TTBARJets_33TEV/	02-Apr-2013 06:52	-	
	TTBAR_13TEV/	02-Apr-2013 07:55	-	
	WGJETS_13TEV/	02-Apr-2013 11:37	-	
	WGJETS_33TEV/	01-Apr-2013 12:58	-	
	WJETS_13TEV/	02-Apr-2013 10:50	-	
	WWJETS_13TEV/	02-Apr-2013 10:02	-	
	WW_33TeV/	01-Apr-2013 12:59	-	
	WZJETS_13TEV/	02-Apr-2013 10:50	-	
	WZ_33TeV/	01-Apr-2013 22:34	-	
	ZGJETS_13TEV/	02-Apr-2013 11:14	-	
	ZGJETS_33TEV/	01-Apr-2013 12:59	-	
	ZJETS_13TEV/	02-Apr-2013 10:44	-	
	ZJETS_33TEV/	01-Apr-2013 12:59	-	
	ZZJETS_13TEV/	02-Apr-2013 09:45	-	
	ZZJETS_33TEV/	01-Apr-2013 13:00	-	
	wjetsmad_33TeV/	02-Apr-2013 08:05	-	

Delphes output Metadata

	Name	Last modified	Size	Description
	Parent Directory		-	
	WWJETS_13TEV_PileUp140_100216231.root	02-Apr-2013 05:32	54M	
	WWJETS_13TEV_PileUp140_100216231.txt	02-Apr-2013 05:32	20K	
	WWJETS_13TEV_PileUp140_100671813.root	01-Apr-2013 20:14	571M	
	WWJETS_13TEV_PileUp140_100671813.txt	01-Apr-2013 20:14	20K	
	WWJETS_13TEV_PileUp140_101030771.root	02-Apr-2013 10:02	557M	
	WWJETS_13TEV_PileUp140_101030771.txt	02-Apr-2013 10:02	20K	
	WWJETS_13TEV_PileUp140_101889767.root	02-Apr-2013 04:34	21M	
	WWJETS_13TEV_PileUp140_101889767.txt	02-Apr-2013 04:34	20K	
	WWJETS_13TEV_PileUp140_102048892.root	02-Apr-2013 09:21	538M	
	WWJETS_13TEV_PileUp140_102048892.txt	02-Apr-2013 09:21	20K	
	WWJETS_13TEV_PileUp140_102354583.root	02-Apr-2013 08:00	523M	
	WWJETS_13TEV_PileUp140_102354583.txt	02-Apr-2013 08:00	20K	
	WWJETS_13TEV_PileUp140_105031426.root	02-Apr-2013 07:57	559M	
	WWJETS_13TEV_PileUp140_105031426.txt	02-Apr-2013 07:57	20K	
	WWJETS_13TEV_PileUp140_105197664.root	02-Apr-2013 07:12	563M	
	WWJETS_13TEV_PileUp140_105197664.txt	02-Apr-2013 07:12	20K	
	WWJETS_13TEV_PileUp140_107589727.root	02-Apr-2013 04:21	367M	

Production Status

~ millions of events reconstructed

Background	13 TeV		33 TeV	
	0 PU	140 PU	0 PU	140 PU
$\gamma\gamma$	~0	~0	~0	~0
γ	20	2.5	~0	~0
ttbar	8.5	0.4	10.5	0.5
W	8.5	0.3	4	0.6
W + γ	8.5	0.3	0.4	~0
Z	0.4	0.1	0.4	~0
Z + γ	8.5	0.4	< 1	0.1
WW	8	0.3	25	0.2
WZ	7	0.4	33	0.3
ZZ	8.5	0.3	1.5	0.4

Signal MC

- Signal MC will not be centrally produced
- If you have not already, start thinking about your signal generation
 - Recipes from Snowmass twiki can/should be used:
<https://twiki.cern.ch/twiki/bin/view/CMSPublic/NPSnowmass2013Samples>
 - Easy once you have LHE files from ME generator

Conclusion

- Background MC production with Delphes well under way
 - Tens of millions of events generated by Madgraph
 - Pythia + Delphes recently started
 - Demonstration of full MC processing chain
 - **Undergoing validation – Not to be used for Physics**
 - **Please download, use, and give feedback**
 - Useful for getting analysis machinery setup
 - Generic LHC-like detector is not yet finalized
- Upon validation, these samples will be available at 3 locations for anyone to download and analyze
 - **Notice and information will be given via snowmass mailing lists and twiki**